



# Aircraft Cabin Turbulence Warning Experiment - Part II

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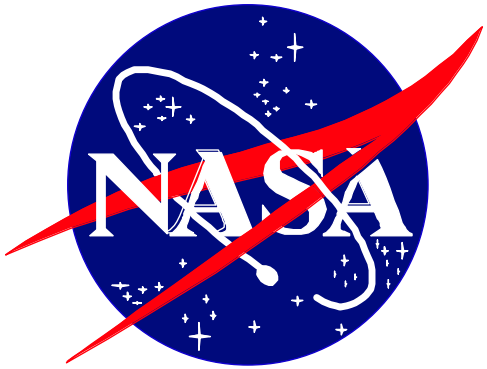
# Aircraft Cabin Turbulence Warning Experiment Part II





# Rationale

- Turbulence is the leading cause of in-flight injuries
- A realistic warning time estimate is needed for radar-based turbulence warning technology being developed
- An aircraft turbulence warning experiment was conducted Oct. 1-3 2002 on a wide-body simulator
- A second turbulence warning experiment is being planned for March 2005 on a narrow-body simulator
- Review of first experiment to assure effective results from second experiment

# Goal & Objectives

***To determine the estimated time required to configure a commercial narrow-body aircraft cabin for safe transit of atmospheric turbulence***

1. Provide an estimate of time required for secured seating of cabin occupants in a narrow-body aircraft configuration
2. Understand the variables affecting the cabin configuration process
3. Establish a benchmark for future reference & compare with wide-body results

# Approach

- Conduct a narrow-body aircraft cabin turbulence warning experiment sequence of timed cabin preparation trials in a commercial aircraft setting
  - Utilize 747 Cabin Evacuation Facility at FAA/CAMI
  - Staff with cabin crews from major airlines
  - Employ passenger subjects funded by NASA
  - Obtain guidance from CAMI Cabin Evacuation Drill experience
- Use team of experienced airline operational staff to develop plans and procedures
- Explore options for rapid seating using “expedited” and baseline procedures

# Approach (cont.)

- Focus on Realism by minimizing “compromises”
  - Realistic Setting
  - Realistic “Atmosphere”
- Emphasize learning about process
  - Explore options for rapid seating & belting
  - Identify variables influencing process
- Focus on Repeatability
  - Duplicate Instructions to Subjects across trials
  - Duplicate Announcements across trials
  - Duplicate Scenarios across attendant crews
- Avoid Crew Competition

# CAMI 747 Aircraft Environment Research Facility

# Methodology (Variables)

- Explore factors thought to influence seating time
  - Procedures
    - "Expedited" (immediate seating)
    - Baseline (preparation for landing)
  - 3 Scenarios (cover typical situations)
  - 3 Cabin Crews (cover crew variability)
  - Passenger & Flight Attendant pre-trial briefings stressing a zero false alarm rate
- Secured seating time variable used to assess factor effects (time for seating & belt buckling)

# Experiment Variables

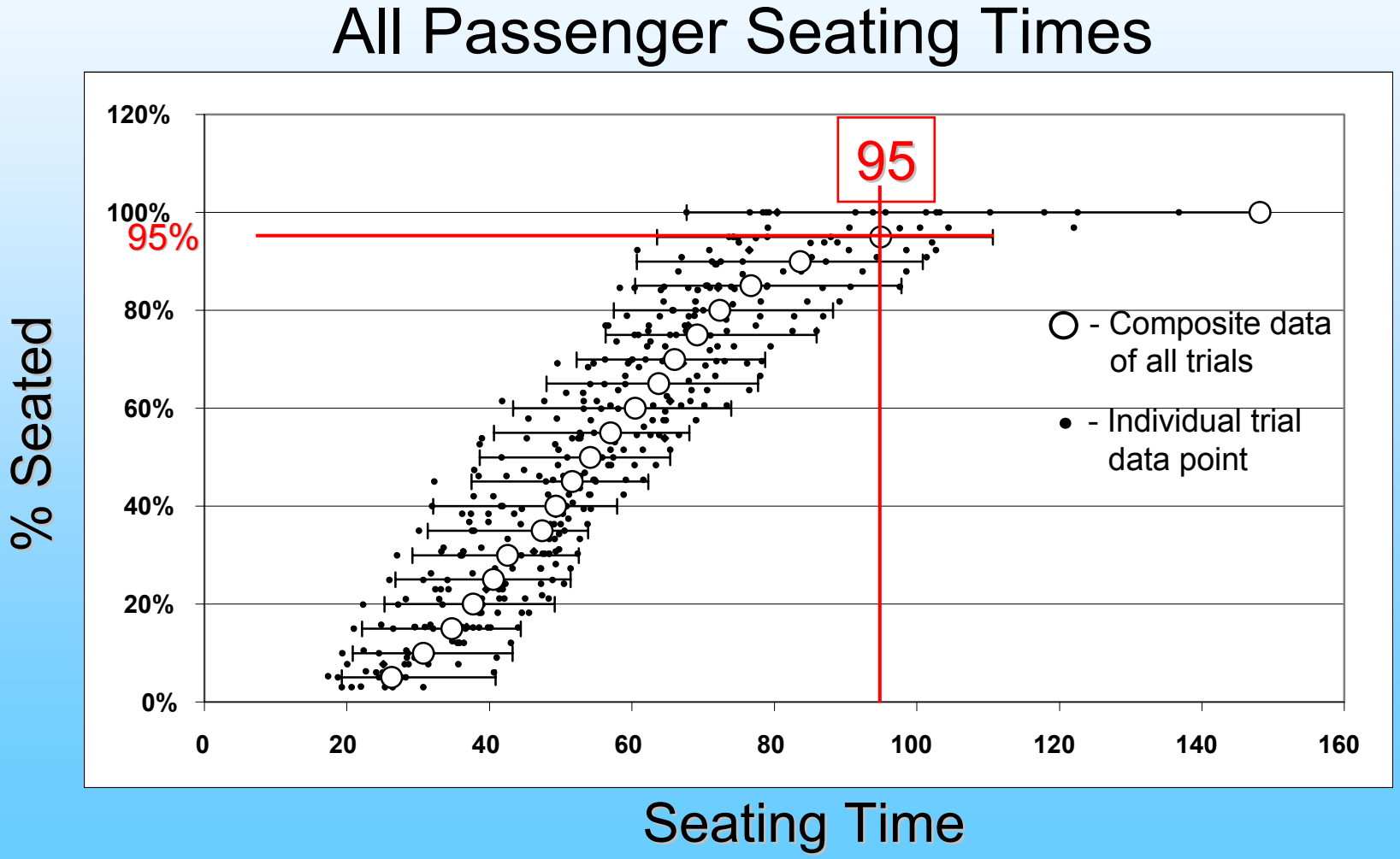
- Cabin readiness time (measured result)
- Cabin procedures (expected to influence result)
  - Expedited (immediate seating)
  - Baseline
- Trial Scenarios (cover typical situations)
  - Long Haul after movie
  - Snack-pack service
  - Food & beverage service
- Airline Cabin Crews (cover staffing variabilities)

# Results from ACTWE I

## Effects on Secured Seating Times

| Subject Population | Scenario Effects | Procedure Effects | Cabin Crew Effects |
|---|---|---|---|
| **Passengers** | Minor<br>Expected effects 79-99s. | Substantial<br>Expedited 86s.<br>Baseline 101s. | Minor<br>Random effects 89-98s. |
| **Cabin Crews** | Major<br>Expected effects 262-606s. | Major<br>Expedited 240s.<br>Baseline 606s. | Major<br>Expedited 75-240 s. |

# Results from All Passengers

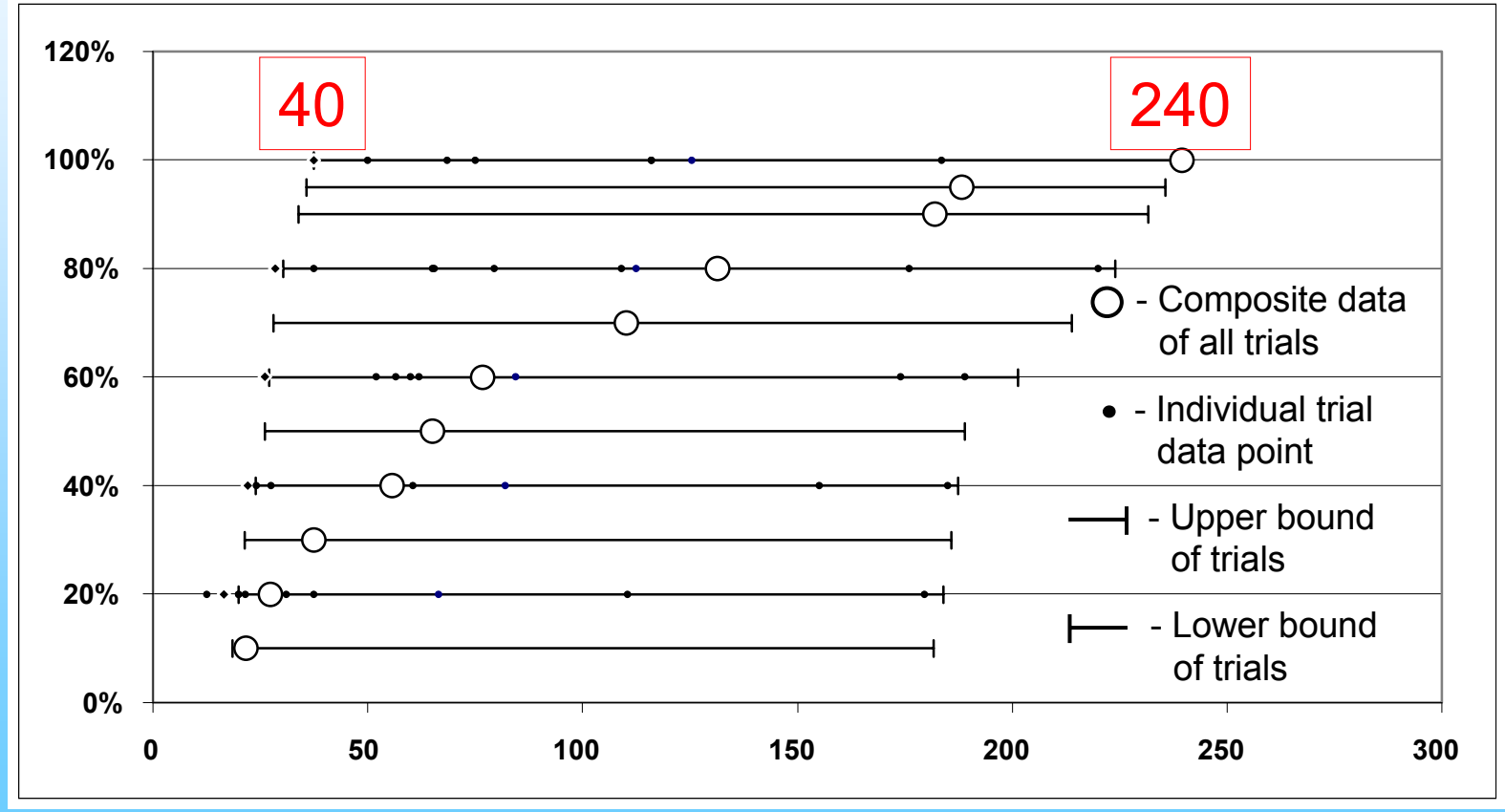


# All Passenger Data Observations

- When viewed as a group, 95% of passengers were securely seated in 95 seconds
- Passengers had consistent secured seating time performance
- Expedited procedure secured seating time was 15 seconds shorter than baseline procedure secured seating time
- Different scenarios had little effect on secured seating time
- Different crews had little effect on secured seating time

# Results from Expedited FA Trials

## All Expedited Procedure Flight Attendant Seating Times



# Observations from Expedited Flight Attendant Data

- When viewed as a group, 100% of flight attendants were seated in 240 seconds
- Trial secured seating times ranged from 40 seconds to 240 seconds to achieve 100% FA secured seating
- A factor of 8 separates the minimum and maximum times to reach 100% secured seating with professional flight attendants following established procedures for expedited seating

# Methodology (Analysis & Scope of Results)

- Passenger seating times determined by video tape analysis
- Flight attendant seating times determined using switches on seat belts
- Data subjected to quality control procedures
- 18 trials over 3 days
- 393 Passenger data points
- 90 Flight attendant data points

# Observations from all Flight Attendant Data

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# Concluding Remarks

- Passenger seating times
  - Probably one of the least controllable factors
  - Highly repeatable results
  - Seating times comparable to radar-based turbulence warning time flight experience
- Flight Attendant seating times
  - Under control of airline procedures
  - Substantial variation between crews
  - Could benefit from industry best practice analysis

# Questions for ACTWE II

- Have the most important variables been identified? (Procedures & Scenarios)
- How important is the "statistical validity" of the results to the Aviation Community?
  - To achieve 30 trials (a common number used to assure validity) with each of 3 scenarios & 2 procedures would require ~10 times the resources ($800k) used in ACTWE I

# BACKUP CHARTS

# Methodology (Trial Sequence)

- Configure cabin for selected Scenario
- Board passengers with carry-on accessories
- Establish initial cabin condition
  - Position passengers in assigned seats
  - Conduct safety briefing
  - Position passengers in initial positions
- Announce impending turbulence encounter
- Allow passengers to return to seats with guidance from cabin crew
- Terminate sequence 1 minute after last flight attendant reaches assigned seat

# Methodology (Subjects)

- Flight Attendants
  - Line attendants with recent experience
  - Crews from 3 airlines
- Passengers
  - Conform to FAR 25 Appendix J
  - At least 40% female
  - At least 35% over 50 yrs
  - At least 15% female and over 50 yrs
  - Three life size anthropomorphic child dummies
  - Use same subjects for all trials

# Assembling "box people"

# Checking Cabin Configuration

# Checking Cart Readiness

# Boarding Passengers

# Confirming cabin readiness

# Lining up to board